

Positron annihilation spectroscopy: a powerful approach for the advanced characterization of polymer brushes.

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Polymer brushes, dense arrays of macromolecular chains tethered on a surface by one end, are one cornerstone of contemporary polymer science and technology. Practical applications span from the biomedical field (e.g. to generate antimicrobial, antifouling surfaces) to organic electronics, passing through the development of sensors and actuators.

However, to achieve a proper characterization of polymer brushes presents great challenges for conventional analytical techniques [1].

Here we want to demonstrate how Positron Annihilation Spectroscopy (PAS) can be a powerful tool to gain unprecedented insight about these complex, fascinating systems.

Brushes made of a pH-responsive polymer, poly(2-dimethylaminoethyl methacrylate), were grown on silicon wafer by means of surface-initiated atom transfer radical polymerization (SI-ATRP). This allowed their investigation in different conditions: before and after protonation as well as before and after the incorporation of silver nanoparticles.

By means of PAS, the brush density and distribution profile of silver nanoparticles can be obtained without making the least damage to the sample.

One of the most relevant findings that will be discussed is the ability of PAS to discriminate within one analysis between brushes made from different initiators, which usually requires the combination of many different techniques.

[1] Guido Panzarasa, *Chimia*, accepted.

[2] Guido Panzarasa, Stefano Aghion, Guido Soliveri, Giovanni Consolati, Rafael Ferragut, *Nanotechnology*, **2016**, 27, 02LT03 (9 pp).

[3] Guido Panzarasa, Stefano Aghion, Gianluigi Marra, Andreas Wagner, Maciej Oskar Liedke, Mohamed Elsayed, Reinhard Krause-Rehberg, Rafael Ferragut, Giovanni Consolati, *Macromolecules* (submitted).